

## 8.

Vertebrate Fauna of a Tropical Dry Season Mud-hole.<sup>1</sup>

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(Plates I &amp; II).

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## GENERAL ACCOUNT.

The collection and observation of fishes were not among our chief objects of research activity during the seven months, from February to September, 1942, which we spent in the field at Caripito, in northeastern Venezuela. But the concentration and viability of many species in an all but dried up mud-hole in the bottom of a ditch, were so unexpected that I attempted to obtain every species of vertebrate which had been thus terrestrially marooned and was still alive in this most unprepossessing spot. A week or ten days more of rainless weather would have resulted in the extermination of every organism, and would have started them well on the way to fossilization.

As I have stated in a former paper,<sup>2</sup> Caripito has a very pronounced dry season, one which brings extreme suffering to many forms of wild life. The example of the mud-hole, together with a few observations on changes of pattern and color, are the reasons for this paper.

I have to thank Dr. Leonard P. Schultz for his identifications of two-thirds of the species of fish and for his descriptions of two new species found among them.<sup>3</sup>

Ten kilometers south of Caripito on the highway which leads to Quiriquiri and Maturin, a disused, extremely rough, rocky, dirt road leads off to the left. This runs straight about four kilometers, and ends abruptly at a long dismantled oil well. This is known as Well Number One and its failure was our gain, for the jungle grew undisturbed along each side of the deserted road, often meeting overhead and with only half a dozen *campesino* squatters who lived in small thatched huts and cultivated little fields of maize, bananas and cassava. This area, together with higher jungle reached by narrow trails farther on, was frequently visited by us.

The country was rolling, densely wooded with medium jungle, and a small stream usually flowed along the bottom of the slopes.

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<sup>2</sup> *Zoologica*, 28: 9, 1943, pp. 53-59.

<sup>3</sup> *Zoologica*, 29: 5, 1944, pp. 39-44.

Three of these streams were in the area under consideration, all ultimately directly or indirectly emptying into the main Rio San Juan. One small, nameless stream drained a more or less continuous ditch on one side of Number One Well Road, crossing it at one spot by means of fifty feet of large bore pipe. At the time of our first visit, February 21, this pipe was dry and inhabited by several hundred bats.<sup>4</sup>

The ditch to the east of the road at this date was about half filled with water, already separated into a series of disconnected pools. These were decidedly individual as to superficial appearance, some showing open, but opaque, dark brown water, others with the surface completely covered with thick, green scum. The surface was occasionally troubled with bursting bubbles of marsh gas, but I saw no hint of organic life until one day a half dozen loricate catfish appeared floating dead and badly decomposed, and later twenty-seven *Aequidens*, still more decayed, floated in the same pool. Several hauls with a small seine yielded a few characins, cichlids and catfish but the stench was so great and the underbrush obstacles so troublesome that I shifted our activities to other fields. Day by day as the dry season increased, the water sank lower and lower until long stretches of the ditch became dry and parched, and the occasional logs across which we had picked our way to reach the jungle became elevated and useless.

In one corner of what had been a large pool, more than two meters in depth, the one on which the dead fish had floated, there was at last left only a few inches of damp slime, with no free water visible. One day a lizard which had escaped from my snake bag, dived into this sorry mess of mud and decayed vegetation. I scooped up a handful of the odorous material and to my surprise found that I had two catfishes and seven cichlids as well as the lizard. Life persisting under such conditions was worth investigating and on several occasions, armed with trowel and jars, I scooped and dredged and shovelled at this thick, tropical bilge.

My efforts yielded thirty-eight species of three classes of vertebrates, as well as an interesting collection of aquatic insects—water skaters, ranatras and water beetles—and great numbers of small shrimps. The first mentioned resolved into three species of turtles, one frog and thirty-four species of fish. The turtles and the frog were buried considerably deeper than the fish. All were holed up for the duration of the dry season. The sides of this particular ditch were too precipitous for any of these creatures to climb and make their escape, and, as around other similar sludge pits, I saw no tracks which would indicate attempts at escape.

<sup>4</sup> *Carollia perspicillata* (Linnaeus).

Several times I marked individual fish living in the last bit of dampness and after several days all were still there.

What they did not seem willing to put up with was the clear, sweet aquarium water in which I placed them at the laboratory. Even with air-pump supplying oxygen they leaped forth at every opportunity, and flicked and jumped about all night, becoming coated with dirt, dust, feathers and cotton, yet as healthy as they had been in their native corruption. When returned to the aquaria they cleansed themselves and immediately jumped out again whenever the wire cover was removed.

Certain of these fish I would have expected to find existing under these adverse conditions. We have come across *Callichthys*, *Gymnotus* (or *Hypopomus*) and several other genera at Kartabo, British Guiana, travelling through low jungle, a considerable distance from water. *Hoplerythrinus*, *Erythrinus* and *Synbranchus* seem almost to prefer thick mud to clear water. But I did not expect to find delicate characins in good health after weeks in almost unswimmable slime, or *Poecilia* bursting with living young. It was a new experience to scoop up species after species of feebly flopping animated bits of mud and green slime, to find them brilliant, scarlet-and-silver "tropicals," apparently in perfect health.

As often before in the case of tropical fresh-water fish I was interested in the number of species, some closely, others very distantly related, which exhibit patches of brilliant scarlet, either on body or fins or both. Under the present abnormal conditions of existence it was hopeless to look for any hint as to adaptive or other reasons, but nine out of fifteen species of characins showed patches of this bright color.

#### ANNOTATED LIST OF MUD-HOLE VERTEBRATES.

##### FISHES.

##### FAMILY PYGIDIIDAE.

##### *Ochmacanthus flabelliferus* Eigenmann.

Three specimens, mud-hole, March 6, (1) saved, No. 30,016, length 37 mm. Three specimens of this distinct species were caught in the mud-hole. Two were devoured by *Erythrinus* en route to the laboratory. At night all groups of pigment dots disappeared, leaving the fish a homogeneous translucent brown.

##### FAMILY CALlichthyIDAE.

##### *Callichthys callichthys* Linnaeus.

Two specimens, mud-hole, May 7. No. 30,219, length 100 mm. No. 30,220, length 125 mm. Twelve of this species were seen.



in early March floating dead on the surface of this same pool before it evaporated.

***Hoplosternum littorale* (Hancock).**

One specimen, mud-hole, March 19. No. 30,204, length 122 mm.

***Hoplosternum thoracatum* (Cuv. and Valen.).**

Two specimens, one in mud-hole, March 19. No. 30,214, length 77 mm. One in Rio San Pablo, March 19, No. 30,215, length 67 mm.

**FAMILY LORICARIIDAE.**

***Farlowella acus* (Kner).**

(Plates I & II, Figs. 3, 4 and 5).

Three specimens; (1) mud-hole, March 21. No. 30,007, length 105 mm., Color Plate 1527, Photographs 10,002 to 10,006. (2) Rio San Pablo, March 19. No. 30,007a, length 94 mm.; No. 30,007b, length 135 mm.

**Color in Life:** All specimens show similar pattern and coloring. The following applies particularly to No. 30,007. Above ochraceous tawny, beginning at the base of the narrow part of the snout, widening on the head to include the upper third of the orbit, and narrowing behind the dorsal fin to a slender median streak. Entire side of the head and body abruptly dark mummy brown; ventral portions of the head and body pale flesh.

Webs of all fins hyaline. All rays with elongate marks of dark brown, those on the first enlarged element of both paired and unpaired fins especially strong, and continued to tips of long caudal filaments. Most of upper half of caudal black, bisected by a vertical pale band; a strong blotch of the same color filling the lowermost webs of the tail fin. Iris, together with its superior lappet, light golden brown.

At night the entire fish changes to a uniform, pale gold buff, and the ocular lappet disappears.

Every part of the fish except nostrils, mouth, anus and fin webs is covered with a dense coat of minute spines, erect on the snout, curved posteriorly elsewhere. The remarkable disparity in actual weight in armored catfish of equal length is shown by a 100 mm. slender, delicate *Farlowella acus* which weighs only 1.5 grams, and a chunky *Callichthys callichthys* of the same length weighing 21 grams, a difference in weight of fourteen times.

In the aquarium this fish spends most of the day resting quietly on the bottom, but at dusk becomes active, clinging with its sucker mouth to the glass, and slithering slowly about over all four sides.

***Loricaria typus* (Bleeker).**

One specimen, mud-hole, April 23. No. 30,226, length 255 mm. Six fish resembling the above were floating on the surface of the

pre-mud-hole pool on March 5 in advanced stage of decomposition. These I tentatively named *L. maculata* but they may very well have been the present species as named by Dr. Schultz. No. 30,226 was taken from the same locality as the others but after the ditch pool had evaporated to mud and rotted leaf sludge in one corner of the bottom. In the laboratory this individual leaped constantly out of its aquarium and for more than fifty hours at one time lived behind trunks and boxes, matted with dirt but showing no later ill effects.

**FAMILY CHARACIDAE.**

***Aphyocharax erythrurus* Eigenmann.**

Two specimens: (1) mud-hole, April 23, No. 30,230, length 45.5 mm. (1) Rio Caripe, March 21. No. 30,230a, length 48.5 mm.

**Day Coloring:** Silvery yellow with pronounced pale silvery lateral band; two-thirds of the caudal fin and somewhat less of the other fins bright scarlet. A black shoulder blotch. **Night Coloring:** The yellow and the scarlet become fainter, and the shoulder spot disappears. **Post-mortem Coloring:** The scarlet and the shoulder spot vanish completely.

These fish lived well in small laboratory aquariums, and for at least two weeks retained their full coloring. The paling was as complete the first night as on succeeding ones.

***Astyanax bimaculatus* (Linnaeus).**

Twelve specimens preserved out of 32 examined. A very abundant species, more than 250 taken in one seine haul in Rio Caripe. (2) No. 30,264, lengths 26 and 30 mm., Rio Caripe, March 21. (5) No. 30,266, lengths 33 to 35 mm., Rio Caripe, March 28. (1) No. 30,272, length 86 mm., mud-hole, April 23. (4) No. 30,270, lengths 41 to 45 mm., mud hole which now was a pool, the ditch half filled with water, August 10.

**Diurnal Coloring:** Dark greenish above tinged with silvery on head, body and lip; clear silvery lateral line; sides and below yellowish-silvery, as well as lower four-fifths of opercula and chin. Strong black humeral spot and one on side of the peduncle, the latter drawn out posteriorly as a narrow black streak to the tip of the median caudal rays. In some individuals, especially the larger ones (90 to 125 mm.), there was a less pronounced second black blotch back of the shoulder spot. Base of dorsal, upper caudal and entire adipose red. In five out of 32 specimens the red on the fins was replaced with pink or yellow.

***Astyanax metae* Eigenmann.**

One specimen, No. 30,225, length 83.5 mm mud-hole, April 23. From my series of tentatively named *A. bimaculatus* Dr. Schultz has distinguished this individual as *A. metae*.

named by Eigenmann from the Rio Negro in Colombia. The shoulder spot is lacking; the peduncle spot is faint but the caudal fin mark is wider and more conspicuous than in *bi-maculatus*.

***Bryconamericus beta beta* Eigenmann.**

Thirteen specimens: (1) No. 30,004, length 42 mm., mud-hole, March 21. (12) out of 22 seined. No. 30,247, lengths 23 to 45 mm., Rio Caripe, April 23.

*Diurnal Coloring*: The entire fish is silvery but patternless except for a black peduncle spot. The tips and edges of the fins pearly white. The basal half of the anal end of the caudal and upper fifth of the iris are bright red. When extremely excited a vertically elongated humeral spot appears, but soon vanishes when the fish becomes quiet. In an aquarium the fish keep in the central part of the water in a loose school but with complete individual independence, swimming back and forth apparently without rest, day and night. *Post-mortem Coloring*: Soon after death the humeral spot appears and in some cases remains. The red soon goes.

***Copeina arnoldi* Regan.**

Five specimens: (4) No. 30,241, length 22 to 30 mm., mud-hole, May 23. (1) No. 30,236, length 27 mm., mud-hole, August 10. At this later date rain had relieved the stagnant condition, but there was still no connection with adjoining pools along the ditch.

*Diurnal Coloring*: The red in the ventrals, anal and top of caudal is suffused rather than definite. The most conspicuous mark is the black and white spot at the base of the dorsal.

***Creagrutus beni* Eigenmann.**

Two specimens preserved out of 86 taken: (1) No. 30,063, length 59 mm., Rio Caripe, March 21. (1) No. 30,248, length 50 mm., mud-hole, April 23.

*Diurnal Coloring*: Greenish-yellow with silvery sheen, two more or less blue body bands; a very broad oxydized silver lateral band. Like so many small species of characins, much of the dorsal, anal and caudal fins is scarlet, as is the entire iris. *Nocturnal Coloring*: All body pigment bands and most of the red color disappear at night, and the same is true after death.

This is the most restless, nervous fish we observed, never quiet a moment, swimming and twisting about the other fish without stopping, usually in the bottom fifth of the aquarium. At night, when it closely resembled other species, this nervousness would always identify the specific individuals.

***Erythrinus erythrinus* (Block and Schneider).**

Four specimens preserved, many others taken, all from mud-hole: (1) No. 30,271, length 80 mm., April 11. (2) No. 30,221,

lengths 100 and 130 mm., May 7. (3) No. 30,233, lengths 29 mm., August 10.

My detailed color notes on these voracious fish, which in life resemble giant minnows, are of little value, because in life I confused the two genera *Hoplias* and *Erythrinus*. The scarlet of the anal and the upper quarter of the caudal is a persistent pattern. There is considerable difference between the sexes and especially between young and adults. Nocturnal changes are not extreme.

Their voracity almost equals that of the caribé. They will begin to kill, cut up and devour all they can hold, a few seconds after being caught by hand and dropped into a pail of fish. Long after they have eaten their fill they will continue to bite off the fins of any other fish confined with them, and will even mutilate one another.

Although not able to climb the vertical walls of the jungle ditches, I now and then found this species in my artificial pits which were dug at considerable distances from water. They refused to remain in an aquarium, unless confined by a wire top, and at night would join the armored catfish in scrambling about the laboratory floor for many hours. Although soon becoming completely coated with a dense fur of dust, when washed off, they seemed never the worse, even after a night and part of the day.

***Gephyrocharax valencia* Eigenmann**

Seven specimens: (1) No. 30,246, length 35 mm., mud-hole, March 8. (1) No. 30,250, length 26 mm., Rio Caripe, March 21. (3) No. 30,273, lengths 25 to 27 mm., mud-hole, April 11. (2) No. 30,229, lengths 35.5 and 36 mm., mud-hole, April 23.

***Hemigrammus unilineatus* Gill.**

Sixteen specimens preserved out of 48 taken: (1) No. 30,244, length 25 mm., Rio Caripe, March 6. (2) No. 30,249, lengths 25 and 28 mm., Rio Caripe, March 21. (1) No. 30,227, length 39 mm., mud-hole, April 23. (12) No. 30,274, lengths 13 to 20 mm., mud-hole, August 10.

A very abundant little characin, with a superficial resemblance to *Pristella riddlei*, but is never as brightly colored. The median fins are marked with yellow and black. The reddish tail color is unchanged at night, but vanishes with death.

***Hoplerethrinus unitaenitus* (Spix).**

Four specimens from mud-hole, numerous others seined in Rio Caripe: (2) No. 30,237, lengths 34 and 37 mm., April 10. (1) No. 30,039, length 87 mm., April 11. (1) No. 30,068, length 225 mm., April 25.

*Color in Life*: The nine-inch fish from the mud-hole, No. 30,068, was dark gray above, with a slightly lighter line along the side. There was no trace of the pronounced black



lateral band so distinctive of younger fish. Sides bronzy yellow with greenish scale bases. Fleshy white below. Circumorbital cheek plates golden with several dark bands radiating back from the eye. A large black spot on the operculum, and the lower part of this bone clear iridescent bronze green; chin the same. Median fins yellowish with black mottlings. Tail dull reddish-brown, with indistinct mottling. I did not record the ontogenetic and daily changes in color and pattern, but these are very marked. Indians and Venezuelans were seen now and then with strings of these fish up to ten inches in length, speared in small jungle pools and creeks.

**Moenkhausia sp.**

Ten specimens, No. 30,262, lengths 15.5 to 25 mm., mud-hole, April 11.

**Odontostilbon pulcher** (Gill).

One specimen, No. 30,245, length 41.5 mm., mud-hole, April 23. Dominant color, a broad, silvery lateral band; dorsal and anal fins pinkish.

**Paragoniates alburnus** Steindachner.

One specimen, No. 30,263, length 60 mm., mud-hole, April 11. The only definite marking is the peduncle-caudal dark spot, and the deep yellow tinge on the median fins.

**Pristella riddlei** (Meek).

One specimen kept, a few others seen: (1) No. 30,240, length 22 mm., mud-hole, May 23. The mud-hole has been changed to a pool two feet deep, but with no connection with any adjacent pool.

This lovely little characin is apparently as rare in Caripito as it is abundant at Kartabo in British Guiana. Now and then brilliant individual fish were visible in a school of *Hemigrammus*, very probably this species, but the only one preserved was among my collection from the odorous mud-hole. The dominance in the dorsal and anal of black and contrasting bright yellow, and the brilliant red tail fin, characterize the species.

**Serrasalmus eigenmanni** Norman.

Two specimens, No. 30,231, lengths 32 and 33 mm., mud-hole, April 23.

**FAMILY GYMNOTIDAE.**

**Hypopomus beebei** Schultz.

Four specimens, all from mud-hole: (4) No. 30,040, lengths 129 to 150 mm., April 11.

On casual examination in the field I tentatively labeled these fish *Gymnotus carapo*, a common species, and made no detailed notes. The fifteen or more narrow, dark bars across the body form the most distinctive feature in life and they persist after death.

In his description of this as a new species, Dr. Schultz gives the following color and pattern notes: "Body light brownish in alcohol, with 17 narrow dark brown bars across sides to end of anal fin; sometimes an incomplete or broken bar occurs between most or all the nearly complete bars; pectoral fins and anal fin with numerous dark brown pigment specks; tail beyond anal fin with about 3 more brown bars more or less obscure or absent."

These fish lived for two weeks in a small aerated aquarium. They were as persistent dry land travelers as *Erythrinus* and escaped three times from their tank. Twice they made their way the full length of a twenty-foot corridor, and thoroughly encased in dust and floor debris, were then close to the outer door. Although stiff with dirt, they flapped vigorously when I picked them up and after being cleansed were none the worse for their adventure.

When they swam to the end of the aquarium they seldom bothered to turn around, but like *Gymnotus*, reversed the rippling anal fin and swam backward with the utmost facility.

**FAMILY SYNBRANCHIDAE.**

**Synbranchus marmoratus** Bloch.

Seven specimens preserved out of about twenty, all from mud-hole: (3) No. 30,041, lengths 88 to 108 mm., April 11. (4) No. 30,261, lengths 82 to 104 mm., May 6.

**FAMILY CICHLIDAE.**

**Aequidens pulchrum** (Gill).

Five specimens preserved, out of many seen or taken: (2) Nos. 30,006c, 30,006d, lengths 69 mm., Rio San Pablo, March 19. (1) No. 30,006e, length 68 mm., Rio Carine, March 21. (2) Nos. 30,006a, 30,006b, lengths 75 and 62 mm., mud-hole, March 21.

I have already recorded the changes of pattern and coloration of the individual fish No. 30,006a. under the name *Aequidens tetramerus*.<sup>5</sup> When complete records are obtained of diurnal, nocturnal, ontogenetic, emotional and post-mortem pattern and color variations and changes, we may perhaps expect some final shifts and decisions in species nomenclature.

Early in March, 27 of these fish, badly decomposed, were floating on the surface of the pool which later evaporated to our mud-hole.

**Cichlasoma bimaculatum** (Linnaeus).

Three specimens preserved of many taken, all from mud-hole: (2) No. 30,235, lengths 30 and 37 mm., April 11. (1) No. 30,223, length 60 mm., May 7.

<sup>5</sup> *Zoologica*, 28: No. 3, 1943, pp. 13-16.

**Coloring:** In recently caught fish of larger size (ca. 60 mm., st. length) several pattern elements are visible. In order of distinctness these are: a large ocellus at upper extremity of peduncle, a sub-ocular spot, a mid-lateral ocellus and a broad dark, lateral band connecting the eye with the mid-lateral spot. In these larger fish the peduncle ocellus is perfectly round and does not extend down to the level of the lateral line. In smaller individuals (30 to 35 mm.) the peduncular marking is narrow and elongate, extending clear to the lateral line.

***Crenicichla alfa* Eigenmann.**

One specimen, No. 30,010, length 51 mm., mud-hole, March 21.

***Crenicichla macrophthalmus* Haeckel.**

Three specimens, No. 30,228, lengths 41 to 63 mm., mud-hole, April 23.

***Crenicichla saxatilis* (Linnaeus).**

Two specimens, No. 30,222, lengths 91 and 112 mm., mud-hole, May 7.

***Nannacara anomala* Regan.**

Three specimens, No. 30,238, lengths 27 to 31.5 mm., mud-hole, April 11.

**FAMILY POLYCENTRIDAE.**

***Polycentrus schomburgki* Müller and Troschel.**  
(Plate II).

Four specimens kept out of 10, all from mud-hole: (3) No. 30,182, lengths 22 to 37 mm., March 10. (1) No. 30,042, length 35 mm., April 11. Color Plate 1566.

**Diurnal Pattern and Color Changes:** The individual No. 30,042, taken from the mud-hole on April 11, showed the following major changes, all in the daytime, the description and the paintings of which were made on the first day in captivity in the laboratory aquarium. Plate II, fig. 5. Two weeks later, a check up showed three of the changes and several intermediate stages, both in the same individual and in other fish.

**Phase One:** Jet black with numerous white dots scattered over the body.

**Phase Two:** The background changes to a grayish-brown, with five, broad, vertical dark brown bands across the body. The white dots of phase one are now seen to bound these bands, none being in the bands themselves or in the pale inter-spaces. Two black bands extend back from the eye, one obliquely up and back, and the other down and back, at right angles.

**Phase Three:** The chief change is the obliteration of some or all of the vertical bands, the whole fish being often light brown, irregularly dotted with roundish, dark brown spots. The median fins may now have wide, alternating, vertical bands of dark and light.

**Phase Four:** The upper anterior fourth of the head and body becomes uniform pale

brown, the remainder of the fish being dark and mottled. In all these light phases the ocular bands are permanent. The iris is mottled dark brown, with a very narrow, very brilliant scarlet inner ring.

**Nocturnal Color:** At night the entire fish becomes pale grayish-white, immaculate.

A favorite resting position is on the elongated rays of the anterior part of the pelvic fins. The first ray is thick and brown; the second projects well beyond the first, is white and thread-like and curled anteriorly; the third ray is elongate, jet black and used as a support. When resting quietly on the bottom, the fish sways continually as in a current, and the extensive dorsal and anal fins are widely expanded, making the fish look like a serrated leaf, as in the species of closely related genera. When slowly moving ahead, or around, or upside down as is frequently the case, the motor power is confined altogether to the pectorals and to the elongate soft, posterior rays of the dorsal and anal fins. These are perfectly transparent and thus detract not at all from the inorganic activity of a drifting dead leaf. The character of the movement adds to this effect, the pectoral and the motor portions of the median fins never waving slowly, but vibrating in a swift blur which enhances their invisibility.

Now and then, without any warning, one or the other of the fish everts its mouth, the lips being elevated and projected forward on a complex membranous support of unexpected anterior extension. It is a slow, elaborate yawn, a habit common to other members of the family.

**FAMILY CYPRINIDAE.**

***Lebistes reticulatus* (Peters).**

Two specimens, No. 30,282, lengths 16 and 18 mm., mud-hole, April 11.

***Poecilia vivipara* Bloch and Schneider.**

Twenty-two specimens preserved out of hundreds: (4) No. 30,038, lengths 18 to 25 mm., mud-hole, April 11. (16) No. 30,265, lengths 17 to 27 mm., Rio San Pablo, May 6.

The majority of these fish were bursting with living young when caught.

***Rivulus hartii* (Boulenger).**

One specimen, No. 30,239, length 34 mm., mud-hole, April 11. General body color buffy yellow with many scarlet dots. Caudal fin wholly yellow in life.

***Rivulus* sp.**

Six specimens preserved from about 20: (5) No. 30,015, lengths 32.5 to 67 mm., mud-hole, March 6. (1) No. 30,234, length 54 mm., Rio San Pablo, August 10.

This unnamed species is brown, spotted with darker above, the pectorals and pelvics lemon yellow, caudal broadly margined with black.

**AMPHIBIA.**

**FAMILY PIPIDAE.**

***Pipa pipa* (Linnaeus).**

large male, not breeding, well down  
mud, full activity. Length 122 mm.,  
May 6.

**REPTILIA.**

**FAMILY MYDIDAE.**

***Geoemyda punctularis* (Daudin).**

small specimens of this straight

necked, red-marked chelonian. One March  
21, one June 13. Mud-hole, Color Plate 1597.  
No. 30,137.

**FAMILY CHELYDIDAE.**

***Batrachemys nasuta* (Schweigg.).**

One small specimen, mud-hole, June 2.  
Single-keeled. No. 30,147.

***Platyemys platycephala* (Schneider).**

One specimen, mud-hole, June 2. Double-  
keeled. No. 30,148.

## EXPLANATION OF THE PLATES.

## PLATE I.

- Fig. 1. Jungle Mud-hole two weeks before the last water evaporated.
- Fig. 2. *Farlowella acus*, Specimen No. 30,007, from Color Plate 1527 by George Swanson, length 105 mm.  $\times 1.3$ .
- Fig. 3. *Farlowella acus*, side view of head.  $\times 6$ .

## PLATE II.

- Fig. 4. *Farlowella acus*, ventral view of mouth a few minutes after death.  $\times 12$ .
- Fig. 5. *Polycentrus schomburgki*. Four pattern and color phases of the same individual fish. Specimen No. 30,042, length 35 mm. Painting by George Swanson.  $\times 1.3$ .





FIG. 1.

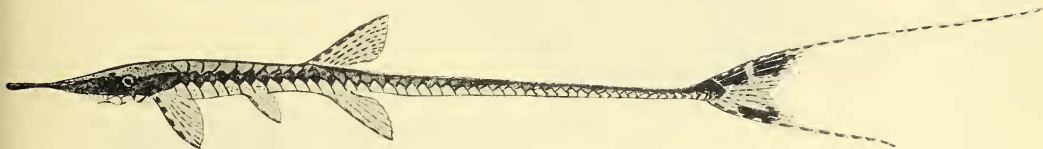


FIG. 2.



FIG. 3.

VERTEBRATE FAUNA OF A TROPICAL DRY SEASON MUD-HOLE.

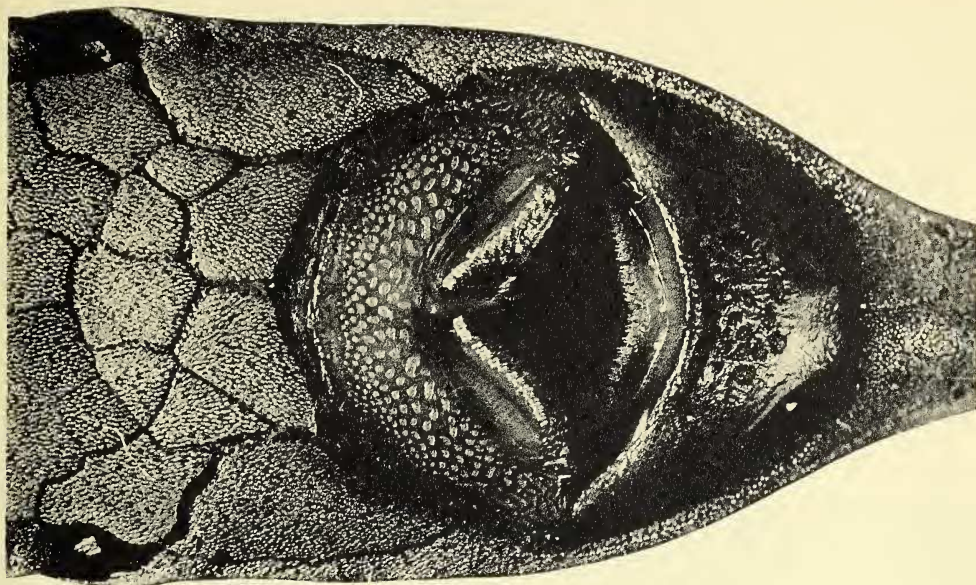


FIG. 4.

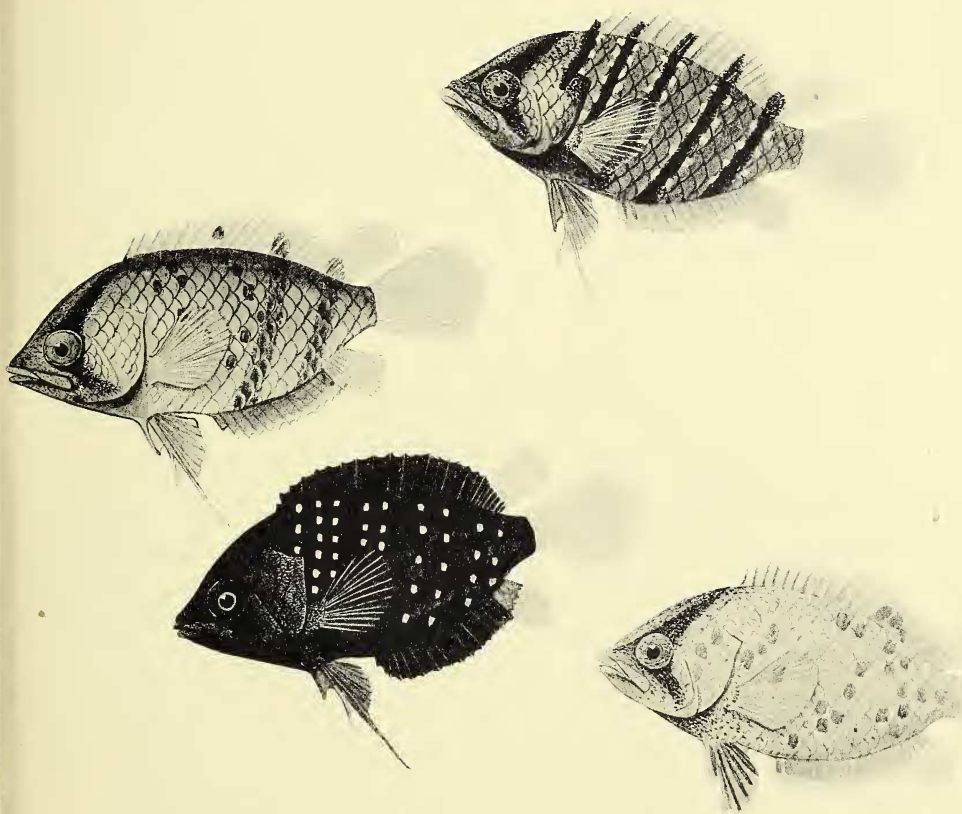


FIG. 5.

VERTEBRATE FAUNA OF A TROPICAL DRY SEASON MUD-HOLE.